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Sanitized Copy Approved for Release 2011/05/25 : CIA-RDP7		8 November 1965		
1. PROJECT TITLE/CODE NAME	2. SHORT PROJECT DESCRIPTION			
Automatic Focusing System		A study to determine the feasibility of utilizing automatic focusing systems on specific equipment.		
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5. class of contractor Manufacturer	6. TYPE OF CONTRACT CPFT			
7. FUNDS	B. REQUISITION NO.	9. BUDGET PROJECT NO.		
FY 19 \$	N/A	NP- I 0-9		
FY 1966	10. EFFECTIVE CONTRACT DATE (Begin - end)	A.A Confidential 25X1 T Unclassified		
FY 19 \$	January 1966 - June 1966	W Unclassified		
12 RESPONSIBLE DIRECTORATE/OFFICE/P	ROJECT OFFICER TELEPHONE EXTENSION	25		
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14. TYPE OF WORK TO BE DONE	and the second s			
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Engineering Development				
15. CATEGORIES OF EFFORT		1		
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R & D CATALOG FORM -- Continued...

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18. supplies, deflection circuits, focusing circuitry, amplifiers, etc. Such equipment is too costly and complex to provide automatic focusing with typical reconnaissance viewers. Other systems in use, such as mechanical linkage devices, require periodic calibration, and these systems are designed to be used with specific lens systems. It would be extremely beneficial to develop a system that could be applied to a variety of lens systems.

This project will investigate the feasibility of automatic focusing systems for existing equipment. The basic technique has been investigated and described in the Journal of the Optical Society of America, Volume 54, No 10, 1261-1266, October 1964. In this approach, the object is imaged on the face of a wide-area non-linear photocell which vibrates in the direction of the optical axis. By sensing the phase of the fundamental component in the output signal, and also certain harmonic content, it is possible to determine the state of focus, or de-focus of the system.

Results have been obtained for a three-dimensional "real world" object space involving a person approaching the optical system, which was fixed-focused for six feet. The successful results with three-dimensional object space, and with an optical system designed to operate over a considerable range of focus distances, indicate that the design of a system to operate on basically two-dimensional objects (photographic film), whose object distance varies over a relatively small range, has a high degree of feasibility.

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TYPE OF WORK TO BE DONE					
Applied Research	•				
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used with specific lens systems. It would be extremely beneficial to develop a system that would not require periodic calibration and could be applied to a variety of lens systems.

This project would prove the feasibility of an automatic focusing system for potential development. Essentially, the program would establish the feasibility of: (1) detecting image sharpness by using the autocorrelation of the image as an indicator of sharpness; (2) using a solid-state correlator as the image sharpness sensor; and (3) developing a signal for driving the projection lens to the position of best focus. The study is intended to show that an automatic focusing system, which can be linked to present projectors by the appropriate servo loops, can be produced. The automatic focusing system will consist of the solid state correlator for obtaining the autocorrelation function of the image; an optical system for projecting two identical images on the sensor; and the required electronic circuits for converting the autocorrelation signals into a form for controlling a servo motor to, in turn, drive the projection lens to the position of best focus. Moreover, the study would determine (1) the sensitivity of the auto-correlation function to focus and, (2) the sensitivity effort should yield -developed correlation sensor. designs for a compact, economical system for achieving and maintaining focus on various projection and direct-viewing devices.

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Basically, a correlator can be used to sense image sharpness because the cross-correlation of two images, both in sharp focus, is substantially higher than the cross-correlation of two defocused images. Plotting light intensity vs position, it can be shown that a focused image will have a higher value on the intensity scale at a given point than the defocused image. This is because the total energy under the curve must be conserved. In the defocused case, the light is spread over a wider position so the intensity must be lower. The correlation function is obtained by multiplying the intensities of the image, point by point, and adding the contributions from all the image points. It is clear that the peak of the correlation curve is lower for the defocused image.

The use of the correlation technique is not new but its application to automatic focusing has been limited because of the cost, size, weight and power required by the implementation. With the use of the solid state correlator developed _______, it should be possible to implement an automatic focusing system that would overcome the problems cited above.

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